Did you know?
April, 2007

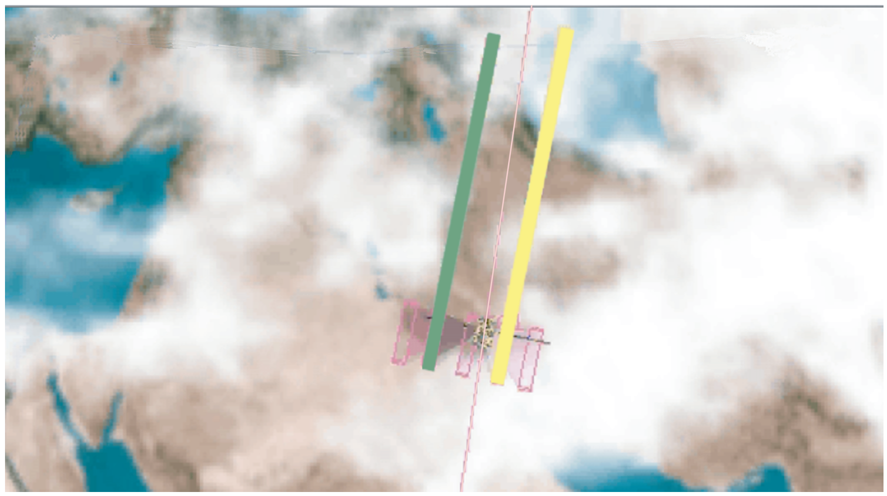
EPOS Clears the View for EOS Observations, Paves the Way for Smarter Sensor Webs

The Earth Phenomena Observing System (EPOS) is an autonomous, dynamic re-tasking technology currently in operational use by EO-1 (Earth Observing-1). Developed by Draper Laboratory with funding by the NASA Earth Science Technology Office, EPOS schedules instruments onboard EO-1, specifically the Advanced Land Imager (ALI) and the Hyperion Imaging Spectrometer, to take images of target areas when those areas are most likely to be free of cloud cover. EPOS has demonstrated its utility for increasing the science value of a variety of Earth observations and the technology can play a significant role in developing future sensor web systems.

EPOS can be broadly defined as the combination of two key capabilities: 1) information exploitation and 2) planning and execution. A web service interface receives cloud cover forecast inputs from the Air Force Weather Agency and target requests via email from scientists at NASA and USGS. EPOS generates from these inputs an optimized schedule for the space-based instruments to target those areas of interest. The entire system operates autonomously day and night with minimal human intervention.

During 2006, EPOS demonstrated a success rate of 77% for its target scheduling choices. A 'success' is defined as an image with less than 20% cloud cover. Based on historical data, EPOS has effectively reduced the overall number of imaging attempts by instruments on board EO-1 by approximately 14%. This reduction translates directly to the overall utility of any particular instrument – given that the number of images an instrument can take over its lifetime is finite, it follows that improving the usability of each image will reap benefits, both in scientific value and cost.

While the initial goal of EPOS has been to schedule cloud-free targets for EO-1, the underlying technology applies to any situation in which there are multiple sensors of many types and/or a potentially large set of desired target locations. The capacity to ingest real-time data and task and re-task instruments as necessary makes EPOS directly applicable to sensor web concepts.



This illustration was generated during a set of simulation tests in which EPOS was used to identify the least cloudy path for observations by EO-1. The purpose of the tests was to analyze the benefit of using EO-1 ALI sensor to supplement Landsat 7 imaging activities. For the descending orbit depicted here, EPOS identified the sensor orientation (green line) that would provide observations with the least cloud cover. The yellow line depicts the path of the preset, scheduled sensor orientation, which would have observed significant cloud cover.

The EPOS development team is enhancing the system to include the replanning of sensors on UAVs (Unmanned Aerial Vehicles) and USVs (Unmanned Surface Vessels) being fielded by NASA over the next few years. The idea is to create a web of sensors that can be re-tasked quickly in response to observation data and/or predictive models in order to measure significant Earth science events in a timely manner. Such a sensor web, combined with the replanning capability of EPOS, could help to characterize a number of local, temporal events: severe weather, algal blooms, volcanic activity, ice movement, seismic events, and even oil spills or search and rescue activities.